

Service Manual
for Digital Blood Pressure Monitor

Model No. WS-540

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1. DESCRIPTION

The Model WS-540-15 is an Auto Inflation Wrist Digital Blood Pressure Monitor. The readings in each function are digital displayed on 7 digits LCD panel.

STATUS INDICATION shows Deflation, Inflation, Palpatory Wave and Battery Weak.

ERROR MESSAGE CODE includes Battery Weak, it is impossible to measure the blood pressure accurately when ERROR MESSAGE CODE appears.

BATTERY POWER is monitored when the unit is turned on and a warning will be displayed if it is too weak.

AUTOMATIC AIR INFLATION inflates the cuff pressure by an internal air pump.

AUTOMATIC AIR DUMP VALVE dumps the pressure in the cuff automatically when the measurement is over or error has been occurred.

AUTOMATIC POWER SHUT OFF:

The unit will automatically turn off if it is not operated for about 180 seconds or more.

2.Specifications

2-1. Model	WS-540-15	
2-2. Classification	CLASS II a	
2-3. Function	① Blood Pressure Measuring	
	② Pulse Rate Measuring	
	③ Automatic Power Shut Off	
	④ 3 Error Indication	
2-4. B.P.M. Specifications		
(1) Measuring Method	Cuff Oscillo-Metric	
(2) Measuring Position	Wrist	
(3) Coverage wrist circumference	125mm ~ 205mm	
(4) Pressure detection	Pressure to Frequency Converter	
(5) Pressure indicating (Cuff Pressure)	① Unit	mmHg EN1060-1 6
	② Range	0 - 300 mmHg EN1060-3 7.7.1
	③ Resolution	1mmHg EN1060-3 7.7.2
	④ Zero setting	Automatic zero setting EN1060-3 7.4.4
(6) Measuring range	① Systolic	50- 250 mmHg Cuff Pressure
	② Diastolic	40- 180 mmHg Cuff Pressure SYS-DIA >10mmHg
(7) Accuracy	① Pressure	± 3 mmHg EN1060-1 7.1.1
	② Pulse rate	± 5 % of Reading
(8) Cuff inflation	Automatic Inflation System (Air Pump)	
(9) Preset pressure	180mmHg (Fixed)	
(10) Cuff deflation	Electromagnetic deflation Control Valve (ECV)	
(10) Deflation rate	5.5 ~ 7.5 mmHg/sec.	
(11) Rapid Exhaust	Automatic Exhaust (ECV) EN1060-3 7.4.3	
(12) Cuff system	① Cuff of Wrist	
	② Locking Mech-Velcro	
	③ Bladder Size	61mm(W) × 128mm(D)
	④ Cuff Size	68mm(W) × 290mm(D)

(13) Indicator	8 Digits + 2 Indicators LCD Display EN1060-1 5	
	① 8 Digits Display	<ul style="list-style-type: none"> • Systolic • Diastolic • Pulse rate • Memory No.
	② Indicators	<ul style="list-style-type: none"> • Palpatory wave (Heart mark) • Weak battery
(14) Memory	① Systolic and Diastolic	
	② 30 measurement results	
	③ Memory Data Average (SYS. DIA.)	
(15) Microcomputer	8Bit Microcomputer	TMP86CH29BU A205121-02
(16) Power Source	R03,LR03 Type (AAA Size) 2 pcs. EN1060-3 7.3.1	
(17) Power consumption	2W (Max.)	
(18) Operating TEMP./Humidity	+10 °C to +40 °C /90% RH or below EN1060-1 7.1.2.2	
(19) Storage TEMP./Humidity	-20 °C to +50 °C /95% RH or below EN1060-3 7.5.1	
(20) Main unit size	58.3mm(W) × 61.4mm(D) × 30.7mm(H)	
(21) Main unit weight	Approx. 90 g (Not Including Batteries)	
2-5. Safety system	Cuff Pressure > 330mmHg → Rapid Exhaust	
2-6. Electrical safety	EN1060-1 7.2.1	
2-7. Resistance to vibration & shock	EN1060-1 7.2.2	
2-8. Air Leakage	EN1060-3 7.4.1	
2-9. Electromagnetic compatibility	EN1060-3 7.5.3	
2-10. Stability of the cuff pressure indication	EN1060-3 7.6	
2-11. Overall system accuracy	EN1060-3 7.9	
2-12. Lay a pipe system	See "10. Exploded Views" P17	
2-13. Operating manual	English / Spanish	
2-14. Accessories	Non	
2-15. Life	5 Year	

3. PRINCIPLES OF OPERATION

3-1. Operation of Each Unit

These units operate as follows:

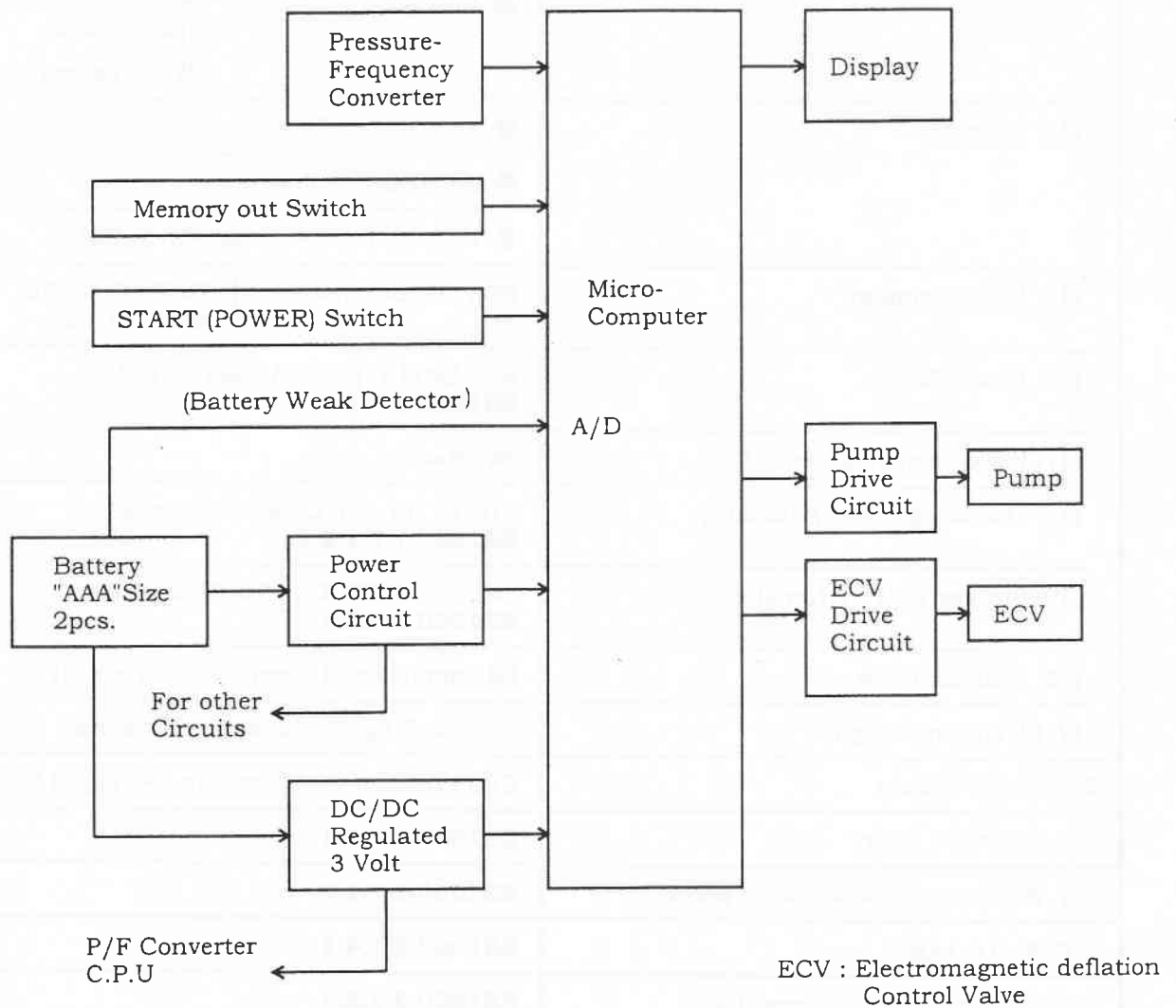


FIG. 3-1 Block Diagram

a) Pressure Sensor

Elastic capsule. Capsule is inflated by pressure.

Parallel Plate variable capacitor;

Gap of parallel plate are changed by inflation.

CR oscillator;

Oscillation frequency are changed by capacitance change.

Frequency Counter;

Frequency are counted by counter and digital output is took in to the computer.
(The counter is included in to the computer IC chip)

b) Others

Power supply control circuit;

Receives the control signal from the microcomputer to turn the power on and off to units other than the microcomputer.

Display Unit;

Displays cuff pressure, maximum blood pressure, minimum blood pressure, pulse rate and information messages.

Electromagnetic deflation control valve (ECV) drive circuit;

ECV drive circuit controls the air exhaust speed regularly during blood pressure measuring by the controlling signal from the microcomputer.
It exhausts the air rapidly after the measuring or when "Err" indicating.

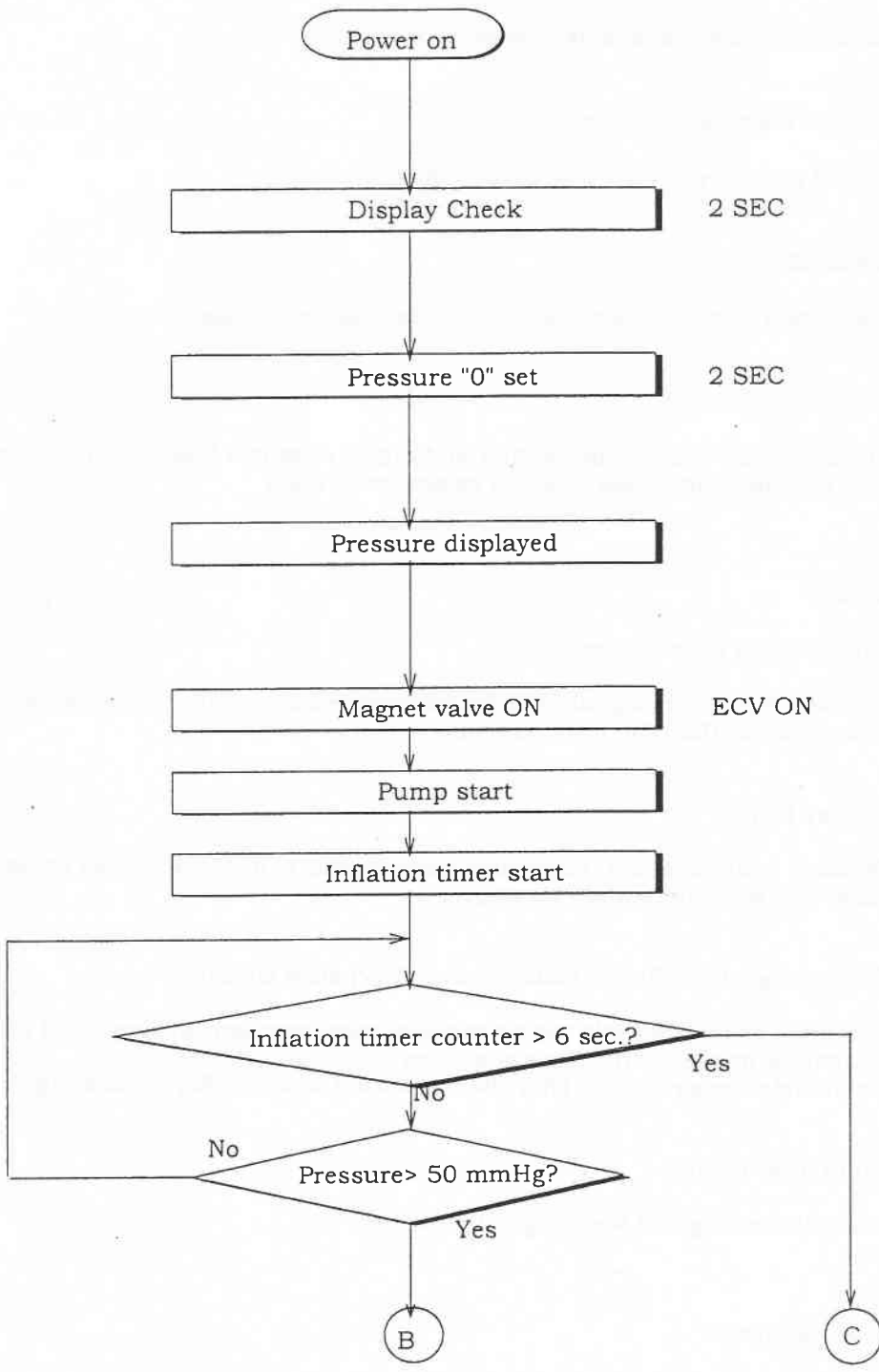
Pump drive circuit;

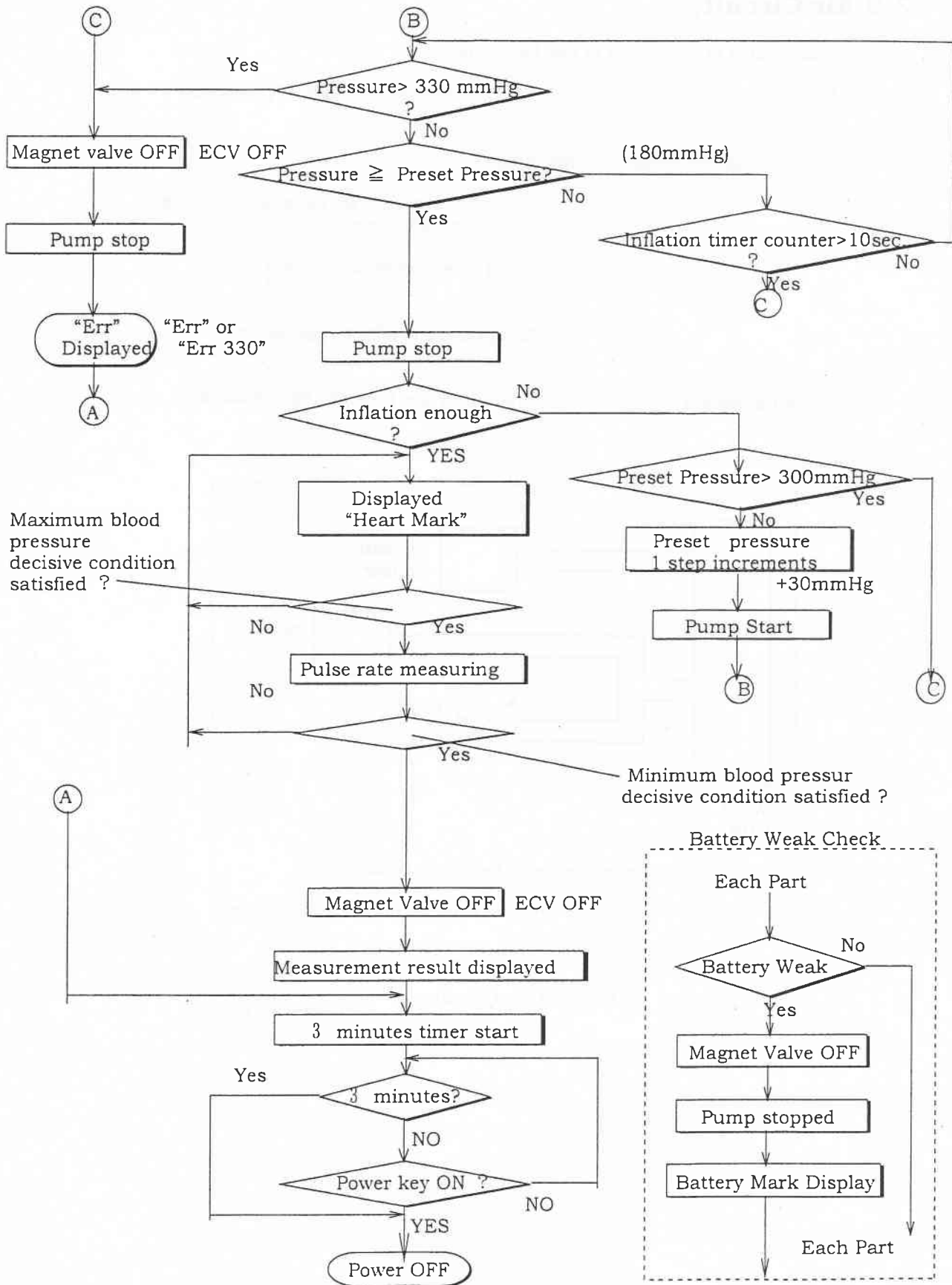
Controls starting and stopping of the pump.

c) Microcomputer

According to the information received, the microcomputer controls the P/F converter, blood pressure measuring sequence and LCD display drive.

3-2 Flow Chart of Operation





3-3 Air Circuit;

The air circuit is composed of the following;

Pump : Used during an increase of pressure.

Electromagnetic deflation control valve

: Used for constant air exhaustion at the time of measurement.

: Used after the measurement.

Cuff : To tighten the left or right wrist.

Pressure Sensor : Frequency are changed by pressure

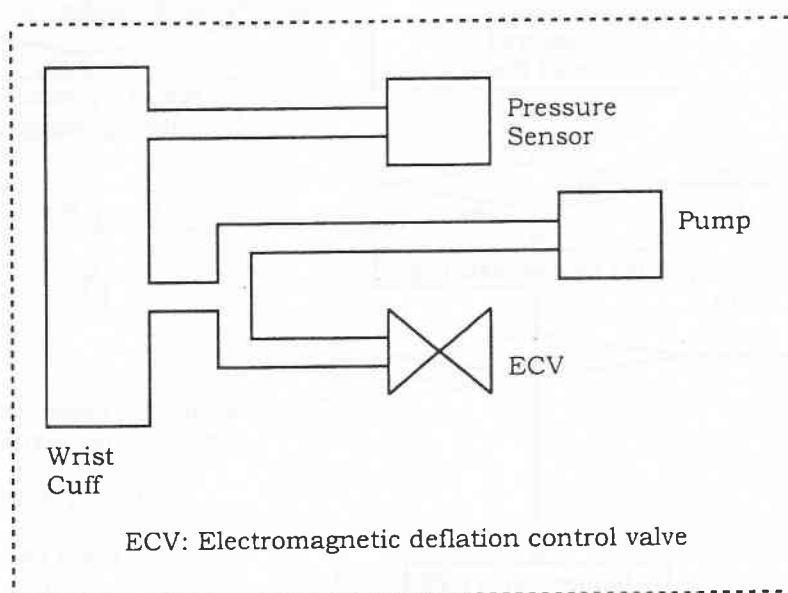


FIG. 3-2 Air Circuit

4. OPERATING INSTRUCTION

4-1 Power Supply

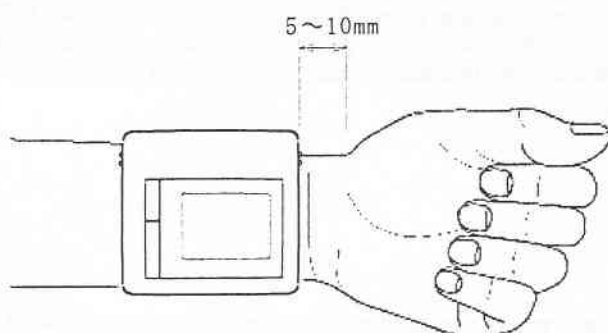
1) In case using battery

Take off battery cover left side of main body and insert 2 pieces of LR03 type batteries to fit polarity indication.

4-2 Measurement Procedures

1) Wrap the Cuff around the left wrist.

Face upwards the palm of the hand, make the body position in the center of the palm, and wrap the cuff tightly to the wrist, leaving no space between the cuff cloth.



In case you wear a wrist watch on your left wrist, please wrap cuff after you put off it.

The position of the individual when being measured may be either lying down or sitting. In the sitting position however make sure that the location on the left wrist to be measured is about at the same height as the heart and that the forearm is extended naturally on the table and does not move.

- 2) Push the "START" switch to automatically inflate cuff to the optimum pressure.
- 3) Pressure start to descend. Please do not move your body as possible as you can later.
- 4) Further descending cuff pressure, indication mark for "Heart mark" flashing to notice pulse wave when the pulse wave begin to generate.
- 5) Further descending cuff pressure and when come to minimum blood pressure, display for "Heart mark" flashing also disappear.
- 6) Minimum and maximum blood pressure is displayed for 3 seconds and pulse rate is displayed for 2 seconds and the different displays are shown intermittently.
- 7) Measurement is completed above all steps. Then the unit will automatically exhaust the air from the cuff.
- 8) If you forget to turn off the power switch after completion of measurement, it will be automatically turned off after 180 seconds.
- 9) In case you take measurement again, you should repeat from item 2) to 7).

4-3 Memory information

- 1) The unit can store the results of 30 measurements in the memory.

Measurement result is automatically stored in the memory when the first measurement is completed and the power switch is turned off.

(Memory No.1 indicates the measurement result obtained in the right previous measurement).

- 2) To recall the memory, press Memory Button, a single push will recall the results stored in Memory 1. Second, third, 4, 5, 6 . . . 30th pushes on the button will recall the results in Memories 2,3,4,5,6 . . . 30.

The memory number recalled will be shown in the Memory number Display Area in the left corner of the display panel.

- 3) If you press the memory recall button in succession by the number of times of memory, and press it again after all the memory data are recalled, you can see in the LCD display the average value of all stored data of Systolic blood pressure and the average value of all stored data of diastolic blood pressure. At the same time, in the area of memory NO. a letter [A] as a marking is indicated.

5. ERROR DISPLAY

This blood pressure monitor displays error message for mistake measurement and weak battery. In case error message displayed during measurement, please relax and please re-measure after confirming how to use.

5-1 Improper pressure

Err 330 *Inflation above 330 mmHg.

Err *Noise is detected by moving body during measurement.
*The exhaust speed is irregular.
The exhaust speed is higher than 8 mmHg/sec. or lesser than 3.5 mmHg/sec.

5-2 Weak battery

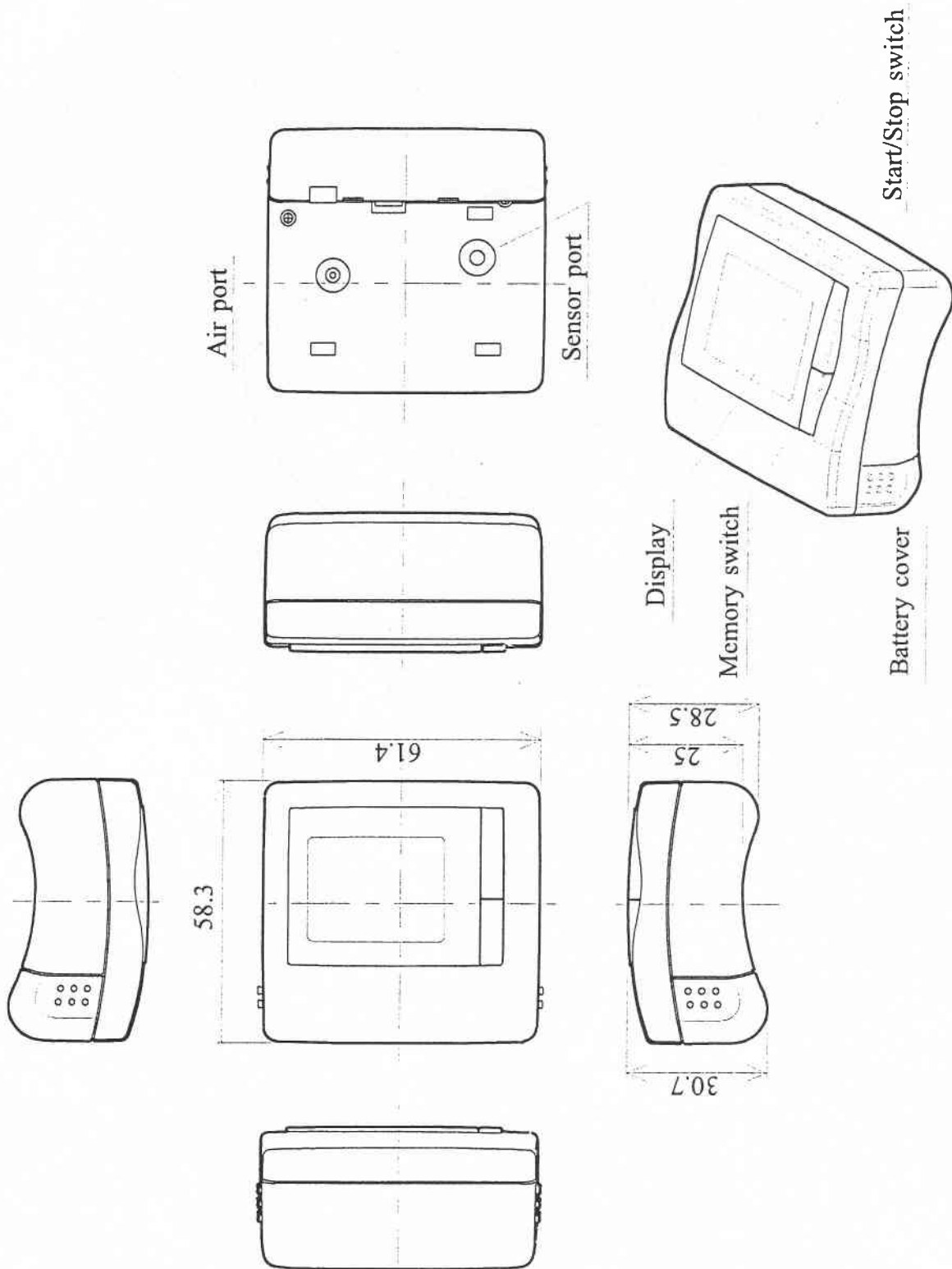
Weak battery provide inadequate voltage for operation of the unit. Batteries need to be replaced.



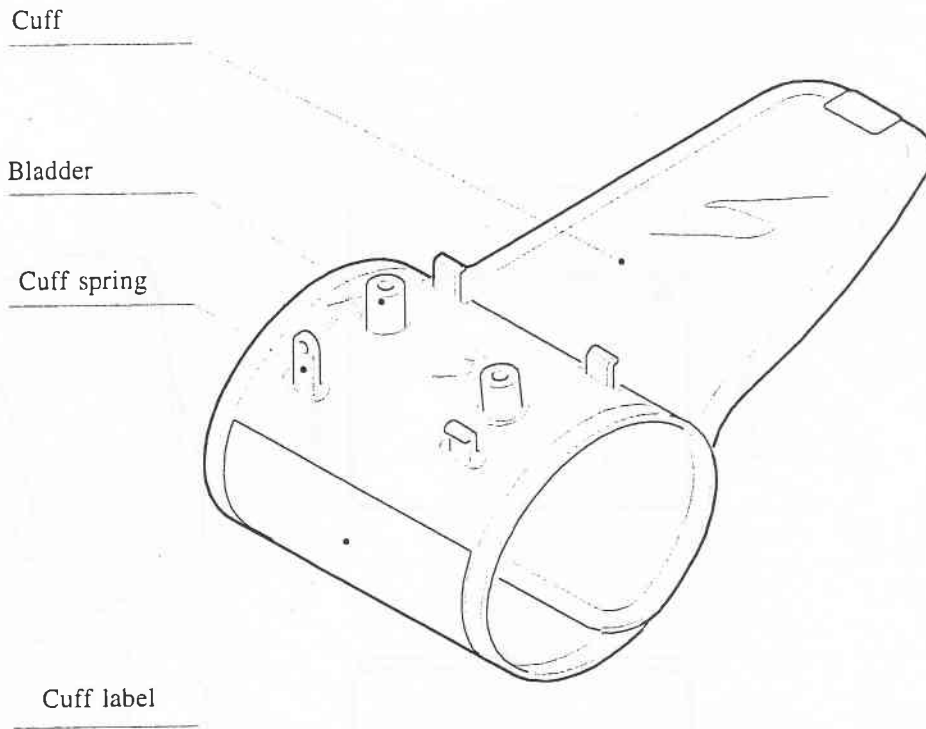
Weak battery

6. OUTSIDE DRAWING

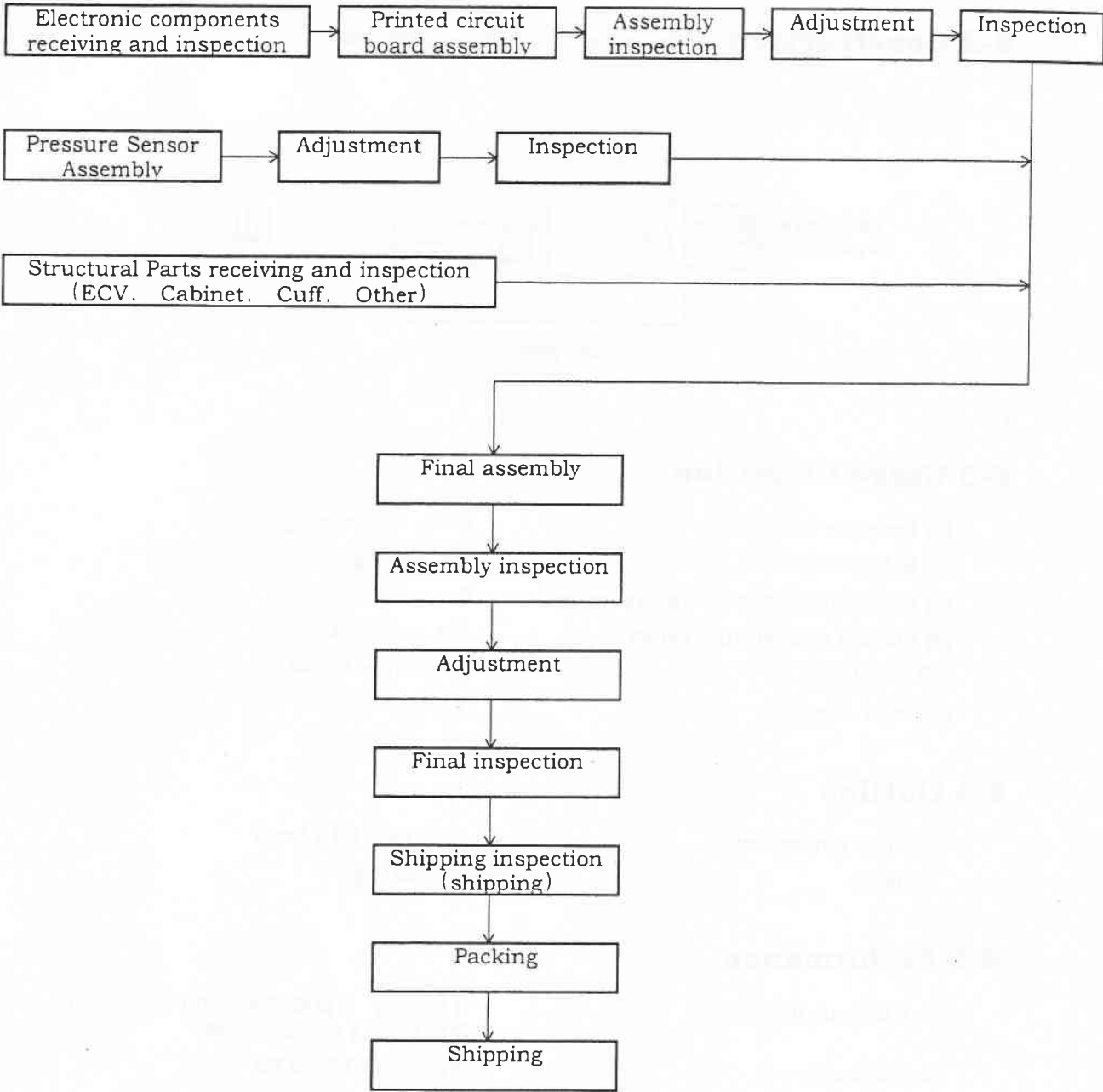
6-1. MAIN UNIT



6-2. CUFF UNIT



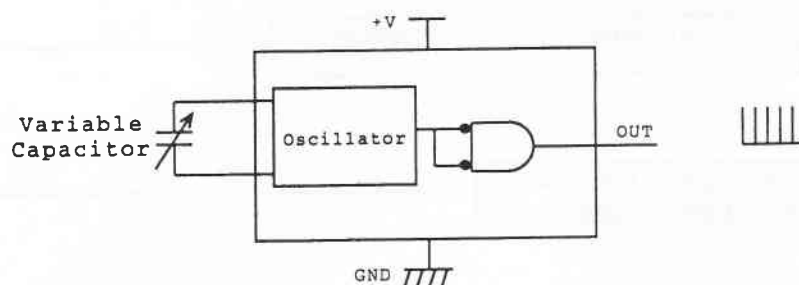
7. PRODUCTION PROCESS TABLE



8. PRESSURE TRANSDUCER

8-1 Model : CS-100

8-2 Construction : Pressure / Frequency Converter



8-3 Usage Condition

(1) Pressure range	0 ~ 300 mmHg
(2) Safety over load	390 mmHg
(3) Compensation temperature range	0 ~ 50 °C
(4) Storage temperature range	-34 ~ 65 °C
(5) Humidity	85% Rh or below
(6) Power supply	3 V ±0.2V

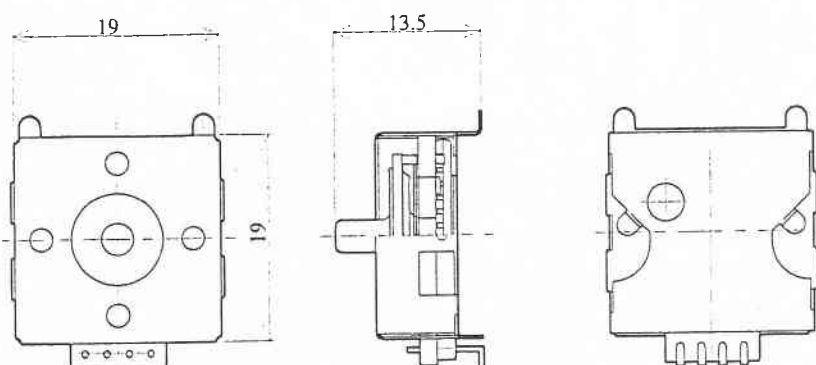
8-4 Outline

Outline dimension	19 × 19 × H13.5mm
Weight	Approx. 7g

8-5 Performance

5-1 Output frequency	0 mmHg : 800 KHz ±300 KHz ··· f0 300 mmHg : f0-240 KHz
5-2 Linearity	Within ±0.3 % of FS
5-3 Hysteresis	Within ±0.3 % of FS
5-4 Span drift	±1% (10 °C ~ 45 °C)

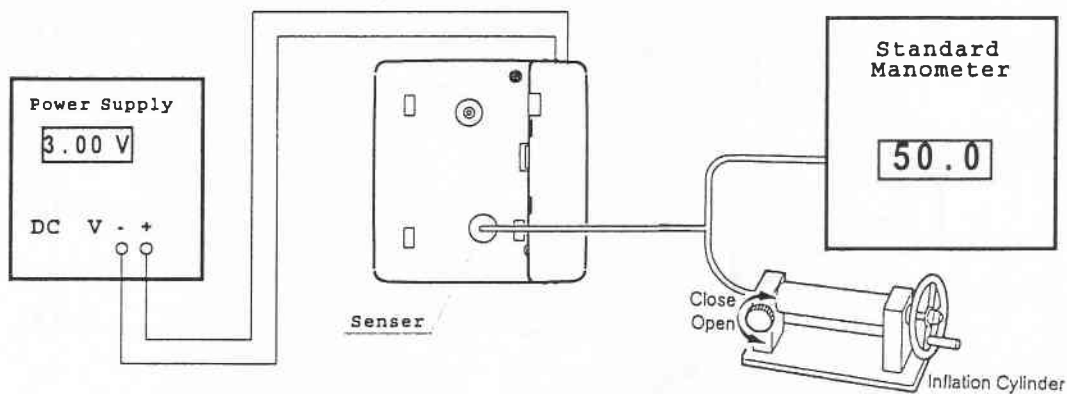
CS-100 Outline Drawing



9. PRESSURE ACCURACY TEST

Connection with Test Device

1. Connect a 3V DC power supply in off mode.
2. Connect the standard manometer and the inflation cylinder, then make it diverge to join the connector used for the pressure accuracy test on the unit.

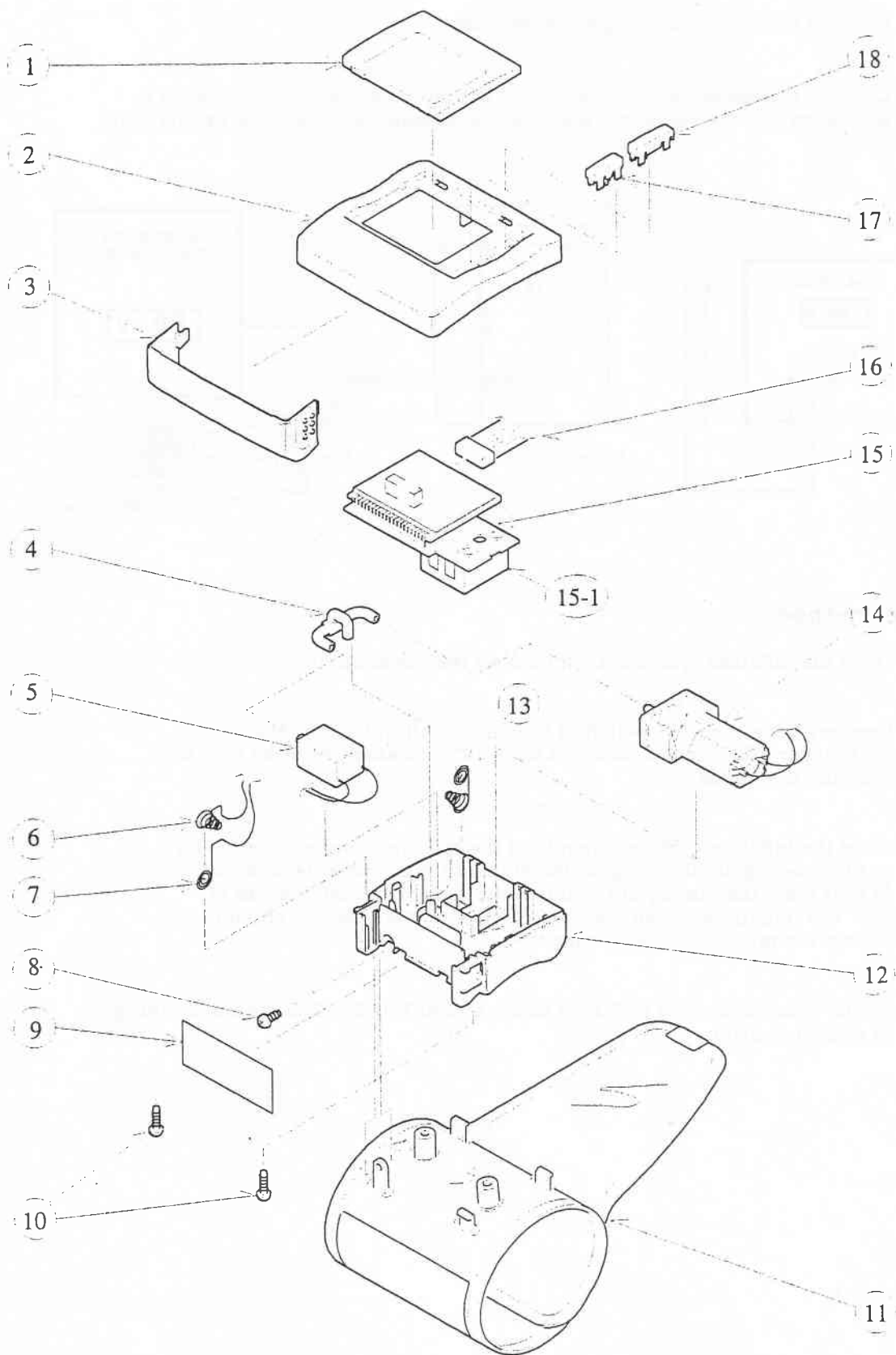


Test method

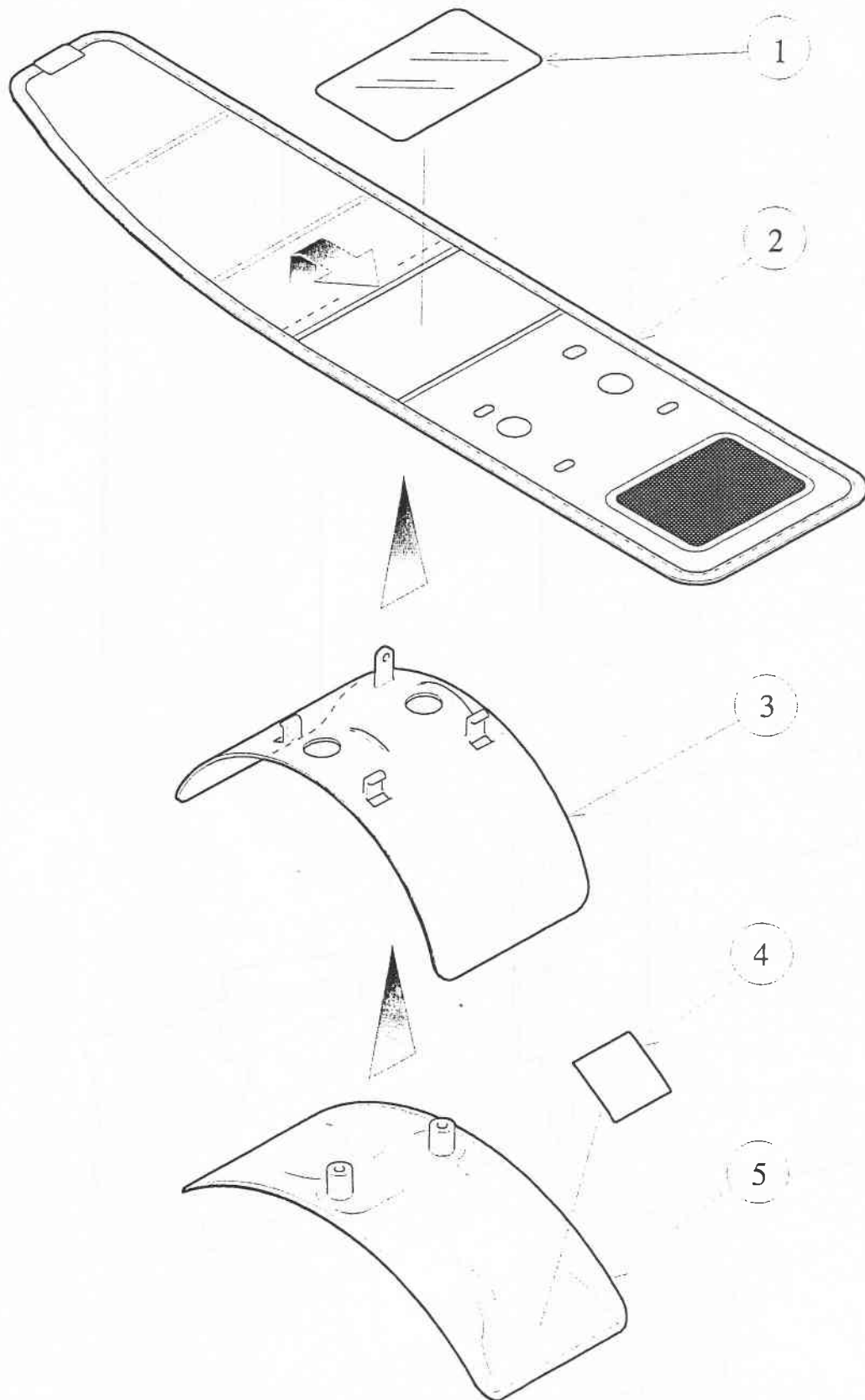
1. Open the inflation cylinder, then turn on the power supply.
2. Keep pressing the start switch of the unit till all-indication disappear. Both upper and under 3 columns show "0" indication, Now the unit is in pressure test mode.
3. Close the inflation cylinder, then turn the cylinder handle to inflate air until a reading of 50 mmHg on the standard manometer is obtained. At that time, the display of the unit should show "50 50" instead of the "0 0" mentioned Step 2 above. Both numbers "50 50" should not deviate too much 50 ± 3 at the most.
4. Do the check described in Step 3 above at 100,150,200,250, and 300 mmHg as well(± 3 mmHg).

10. EXPLODED VIEWS

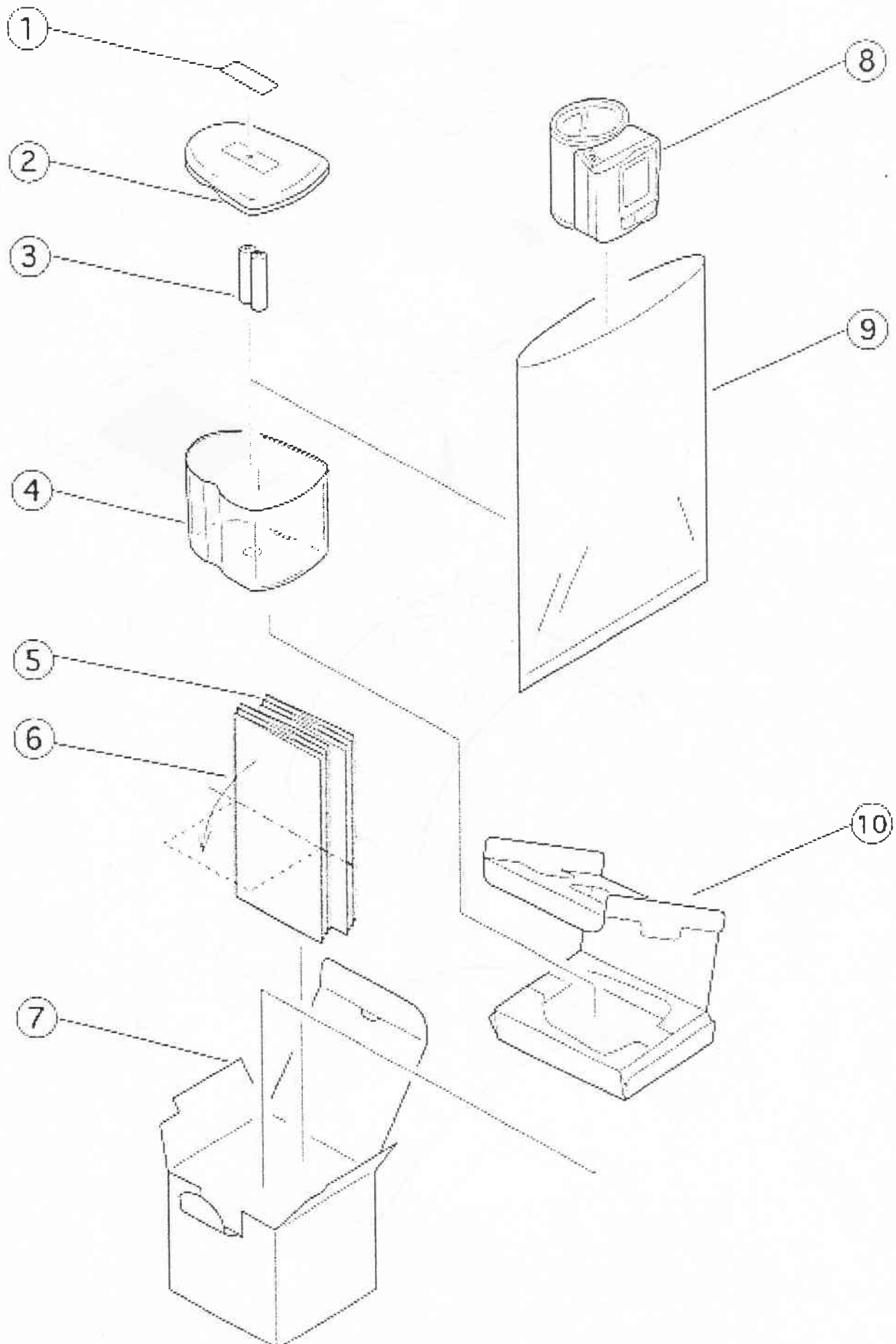
10-1. MAIN UNIT



10-2. CUFF UNIT



10-3. PACKING



11. PARTS LIST

MAIN UNIT

Ref.No.	Description	Part No.
1	Display Panel	B105303-1
2	Upper Case	D104813-1
3	Battery Cover	C104815-1
4	Air Tube	A104570-1
5	ECV(ECV-13-02)	A111573-1
6	Battery Terminal -	A104568-1
7	Battery Terminal +	A104567-1
8	Cuff Holding Screw	A100034-2006
9	Battery Label	A104908-1
10	Case Holding Screw	A100034-2008
11	Cuff Unit	A111524-1
12	Bottom Case	D104814-1
13	Battery Terminal ±	A104569-1
14	Air Pump(DP-130-01)	A106337-1
15	PC Board Assembly	B250867-1
15-1	Pressure Transducer	A250319-1
16	Connector/wire Assembly	A250471-1
17	Start/Stop Switch Knob	B104817-2
18	Memory Switch Knob	B104818-2

CUFF UNIT

1	Cuff Label	A111735-1
2	Cuff	A108104-1
3	Cuff Spring	B104559-1
4	Adhesive Tape	43771PM
5	Bladder	A108108-1

PACKING

1	Carry Label	A105398-1
2	Carry Cap	B104970-1
3	Battery	A210248-1
4	Carry Box	B104972-1
5	Instructions (English)	A111523-1A
6	Instructions (Spanish)	A111527-1A
7	Gift Box	A111522-1A
8	Main Unit	WS-540-15
9	Polyethylene Bag	A100663-10
10	Spacer 500	A105023-1